Application Programming

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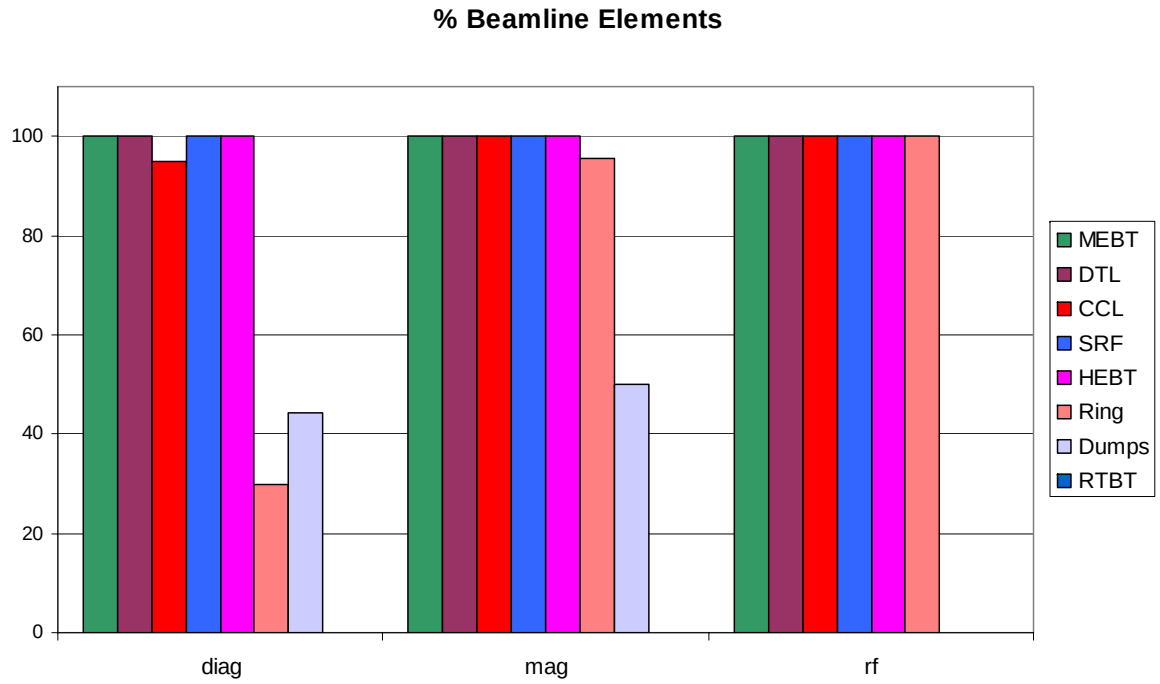
Application Programming Update Since November 2003

- XAL Infrastructure
  - Database population
  - Client - server development
- Online model
  - Benchmarking
  - Example uses
  - Analysis
- Applications
  - ~ 20 XAL applications

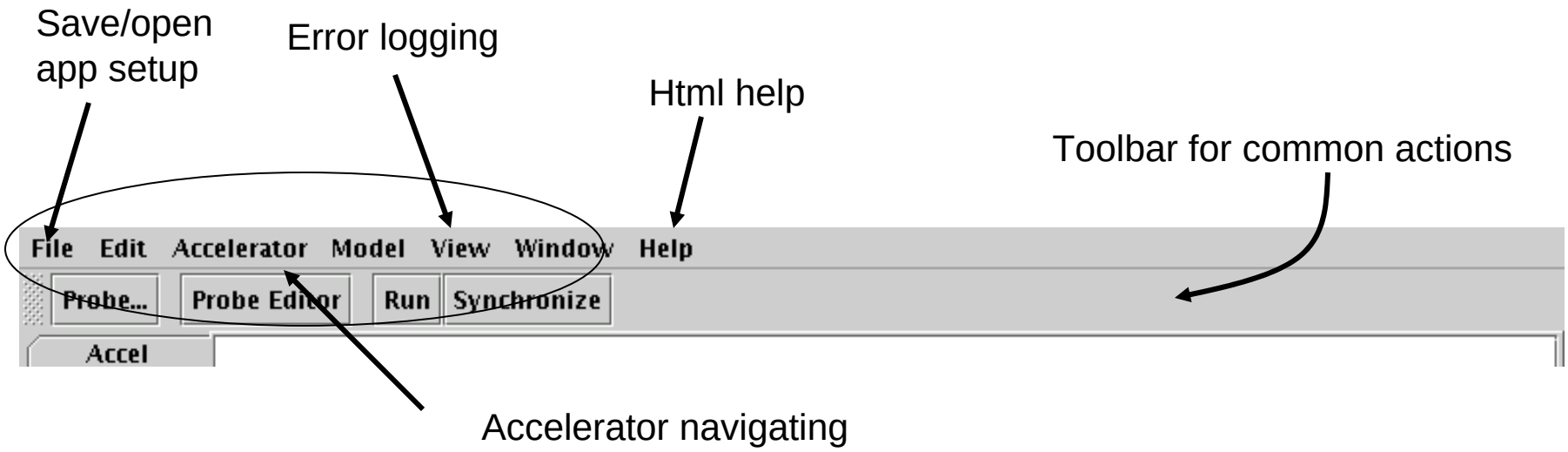
Database Population



- Mostly populated for MEBT -> Ring
  - RTBT, Injection Dump and Extraction Dump are lacking
- Over 1500 beamline elements are populated
- Using database (e.g. global coordinates, PS / magnet mappings)

“Standardizing” Application Program Efforts

•An Application Framework is developed and used as a common starting point for application programs (*T. Pelaia*)



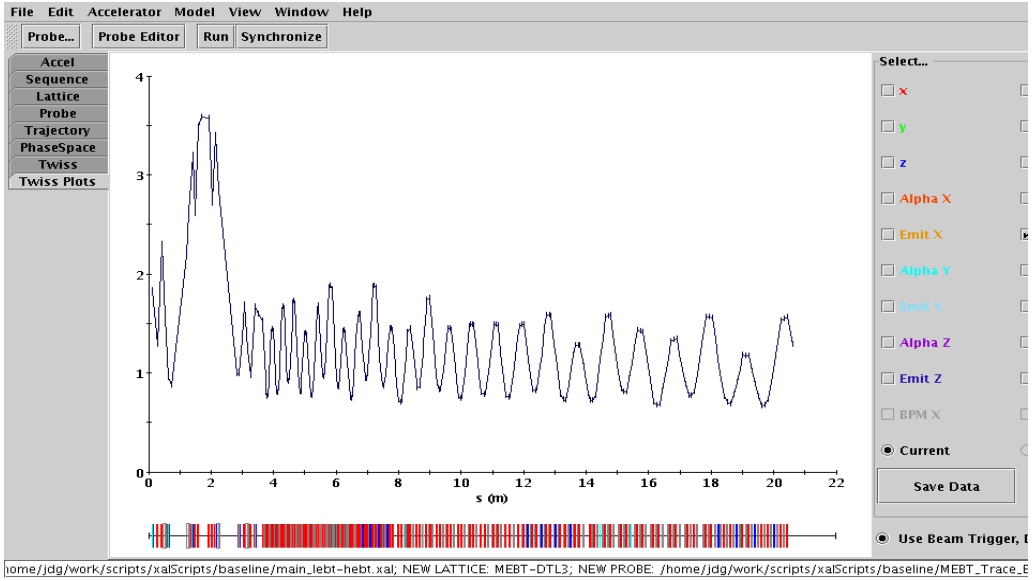
•Common area for data export - subdivided by application

•Accessible from the elog

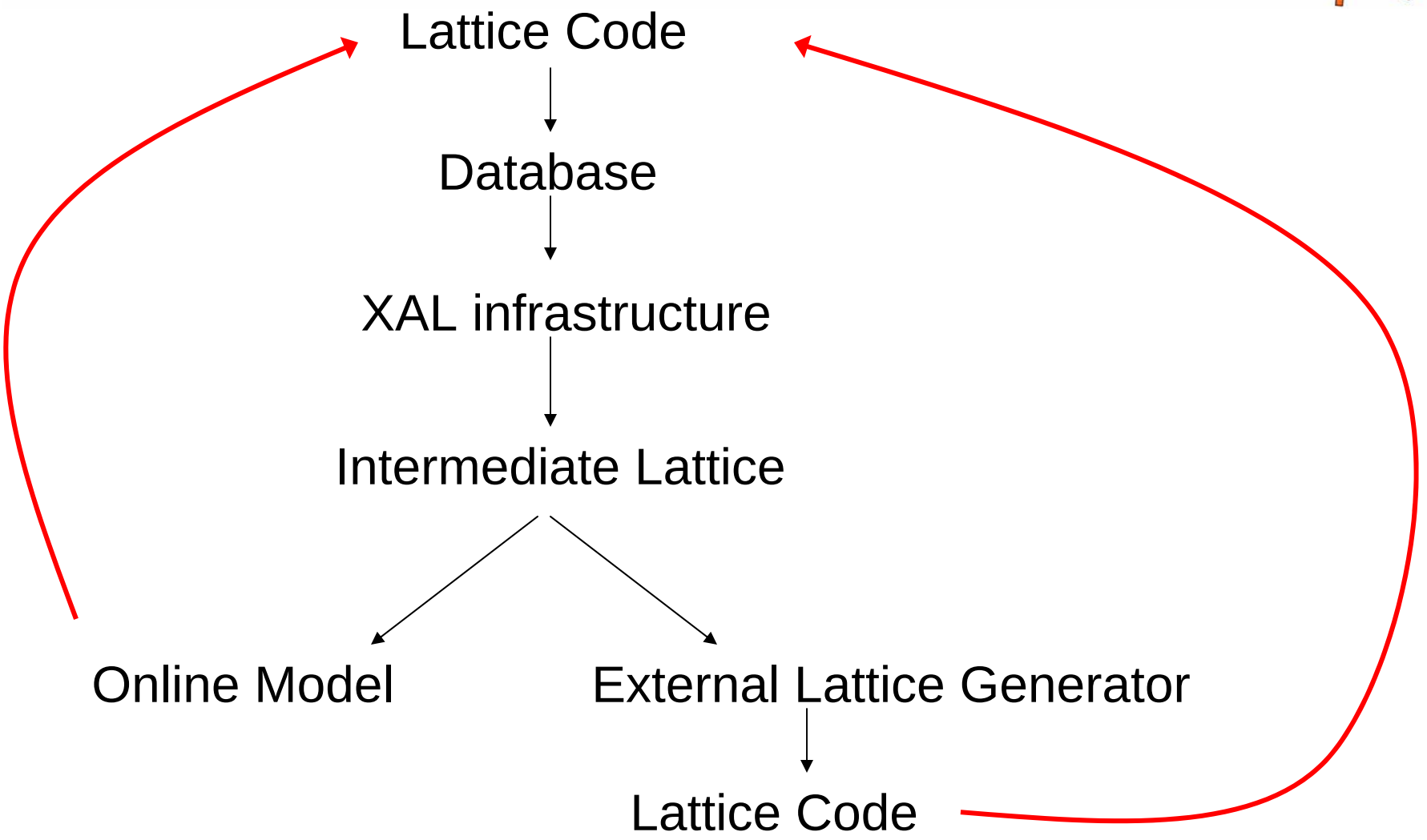
•Use of “time-stamp” file names for data export

The online model *(C.K. Allen, C. McChesney, W. D. Klotz, P. Chu)*

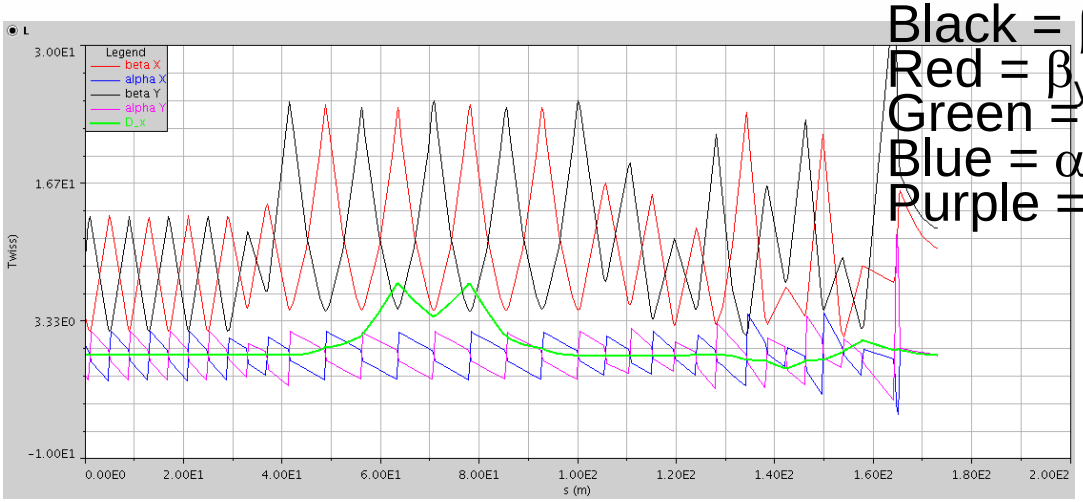
- Algorithm refinement
  - Adaptive step size (with space charge)
  - Ring and transport-line modeling
  - Energy and phase tracking in accelerating elements (e.g. DTL tanks)
- Data source
  - Design
  - Machine
  - Mixed design / machine
  - User “what if” capability
- Data analysis scripts



External Lattice Check Procedure

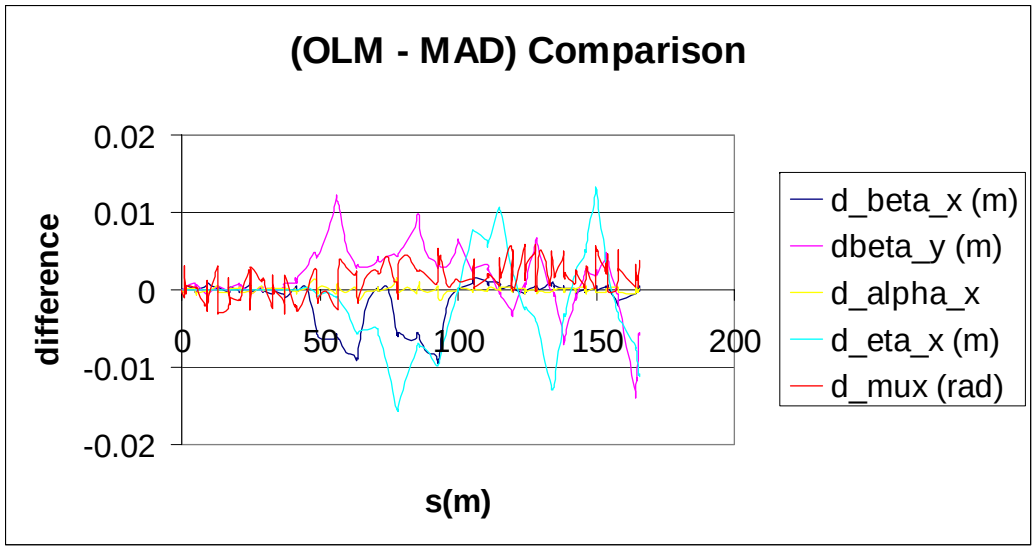


HEBT Lattice Check



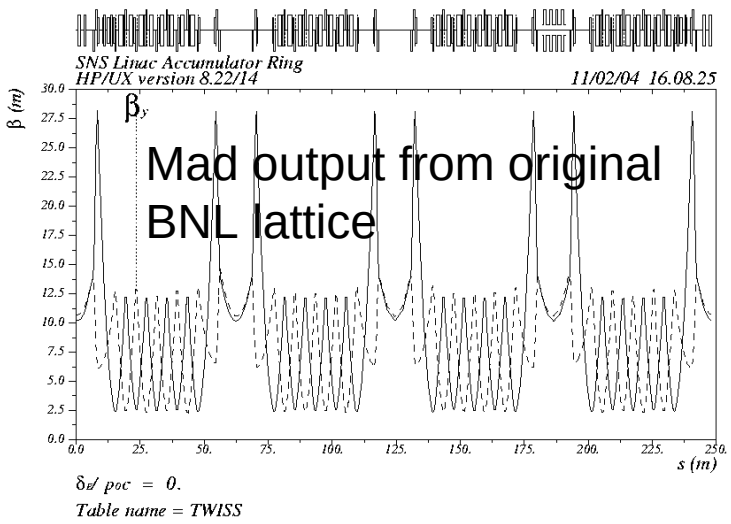
Black = β_y
Red = β_y
Green = D_x
Blue = α_x
Purple = α_y

Online model HEBT results

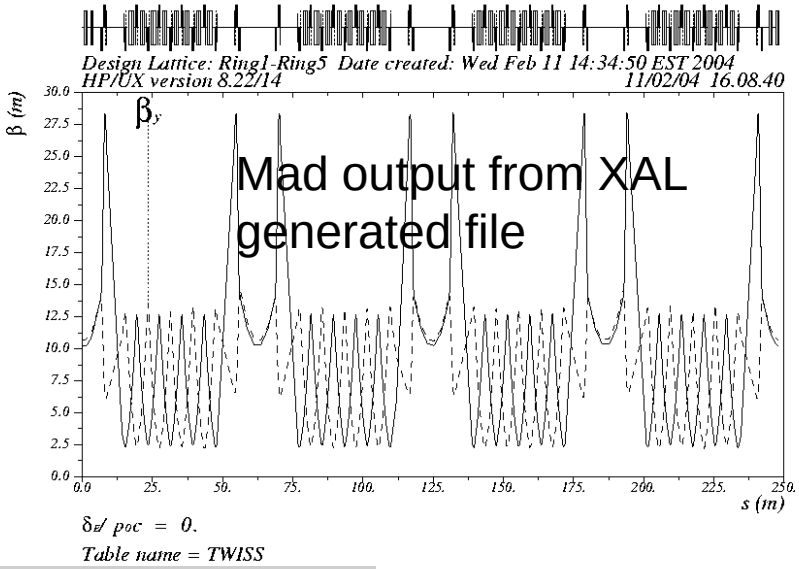


Comparison of online model and MAD results

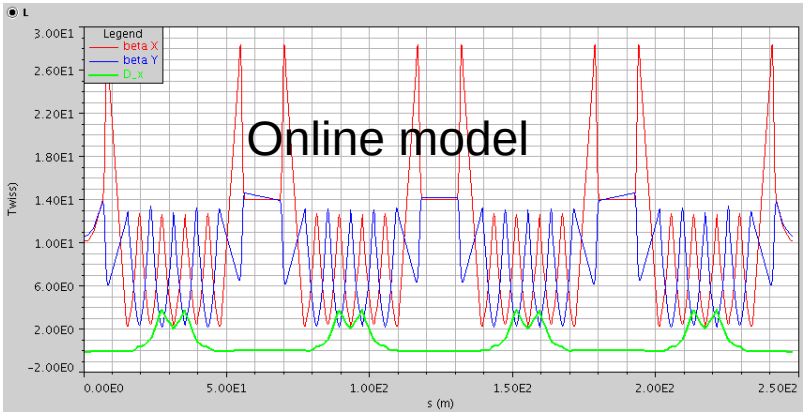
Ring Lattice Check *(P. Chu, S. Cousineau)*



Mad output from original BNL lattice



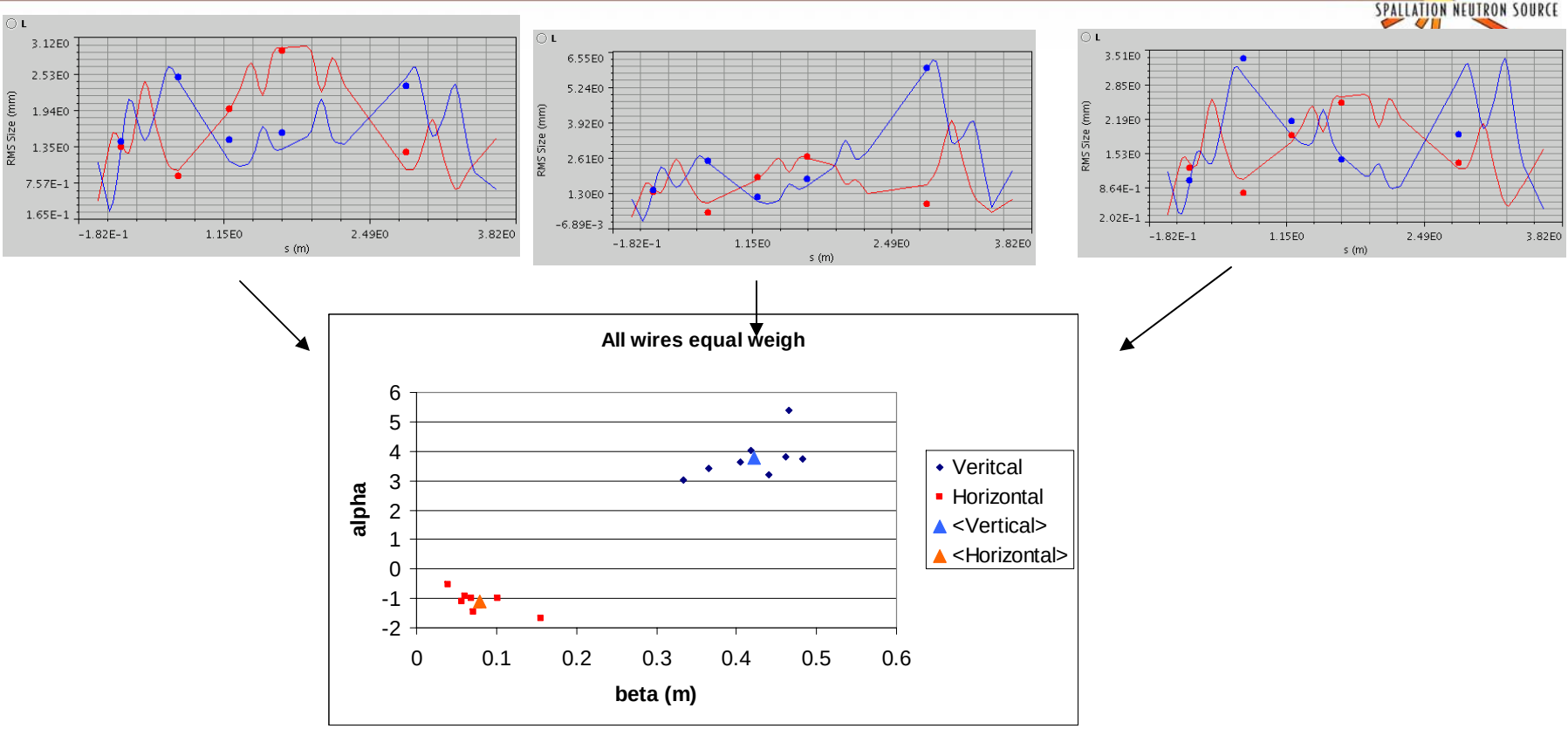
Mad output from XAL generated file



Online model

- Good agreement in MAD results, comparing the original starting point and a file generated with XAL (using default values from the databcase), and the online model.

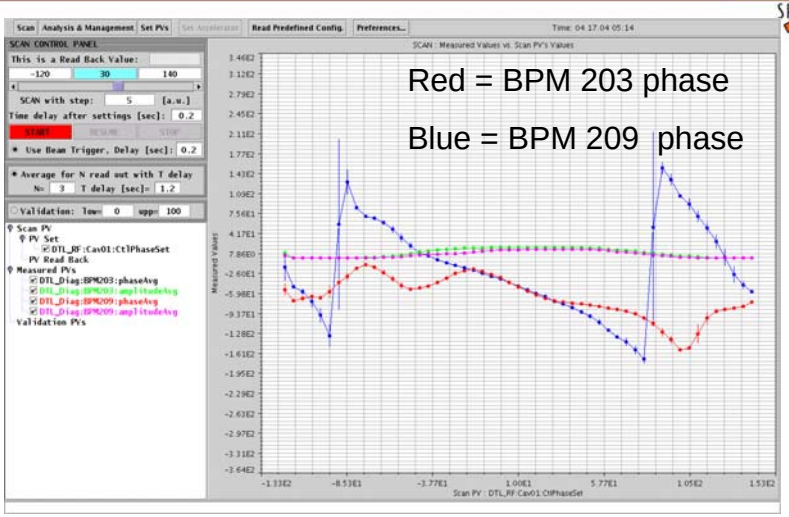
Transverse Beam Property Analysis (preliminary results)



- Compare measured and model predicted beam sizes in the MEBT for a variety of MEBT magnet settings
- Solve for MEBT entrance twiss parameters to best match measured wire profiles under a variety of quad settings
- Uses solver + online model packages within a script.

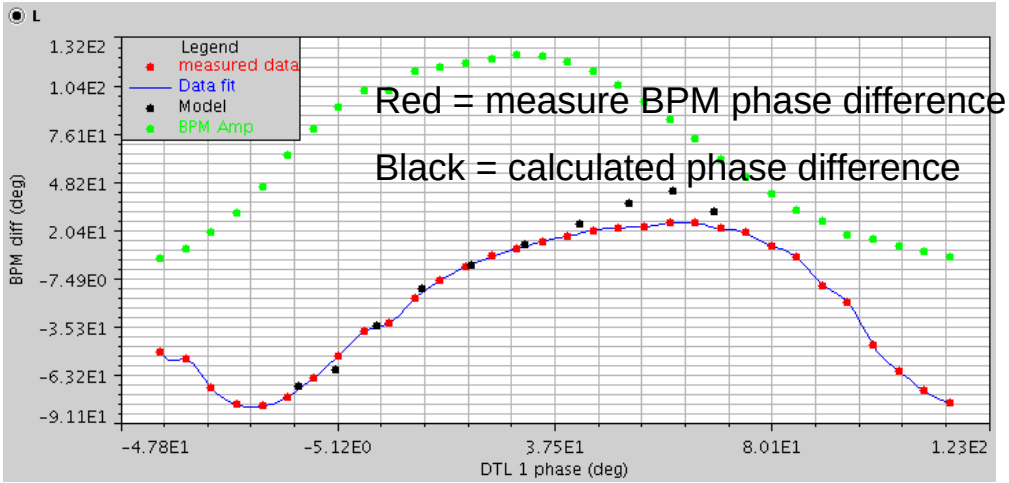
Longitudinal phase scan signature matching analysis (preliminary)

- Scan the DTL tank phase and observed downstream BPM phase signature



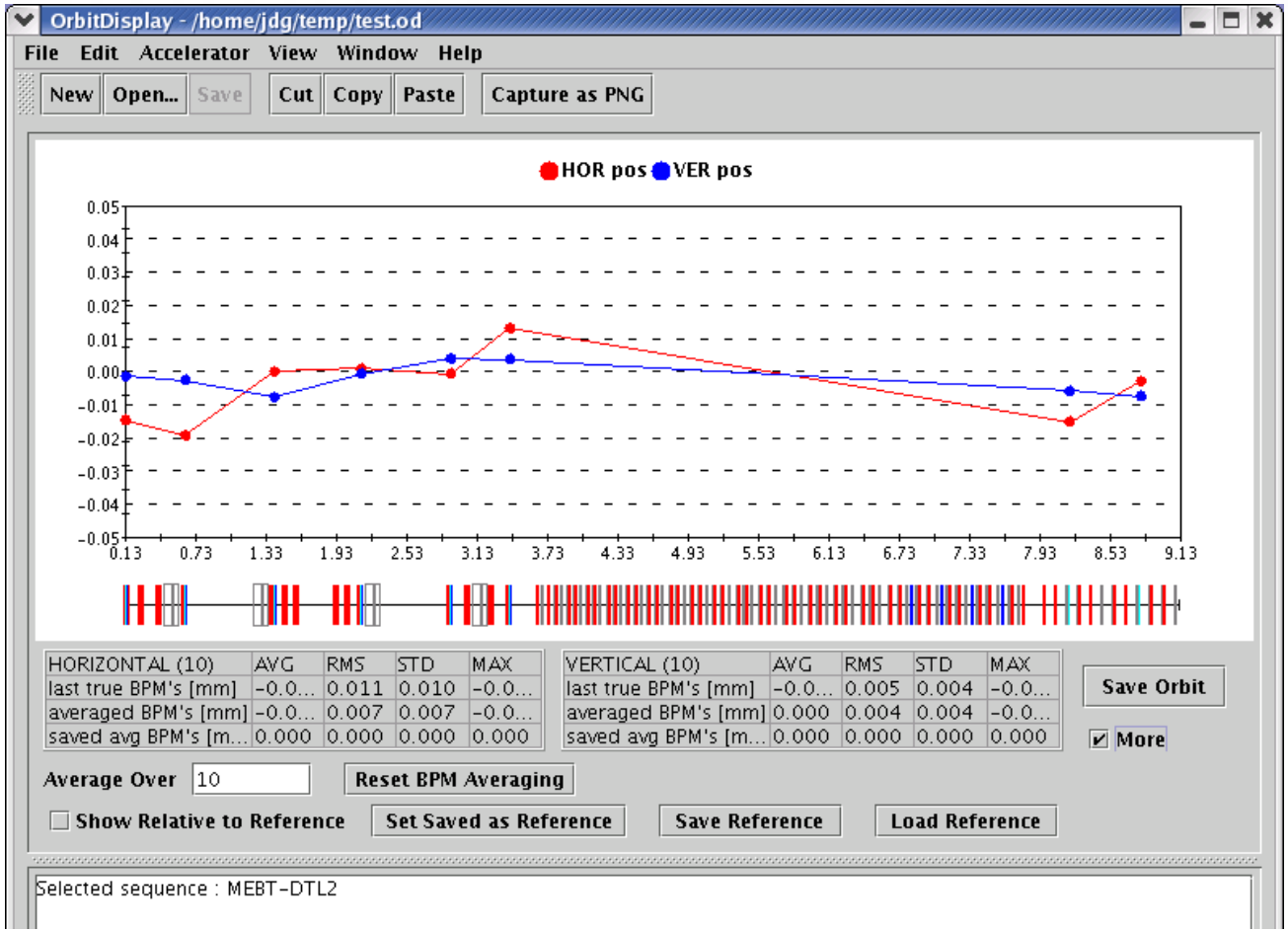
DTL phase

- Match the observed BPM phase difference signature with the online model by varying the input energy, cavity phase and amplitude.
- Done offline with a script



DTL phase

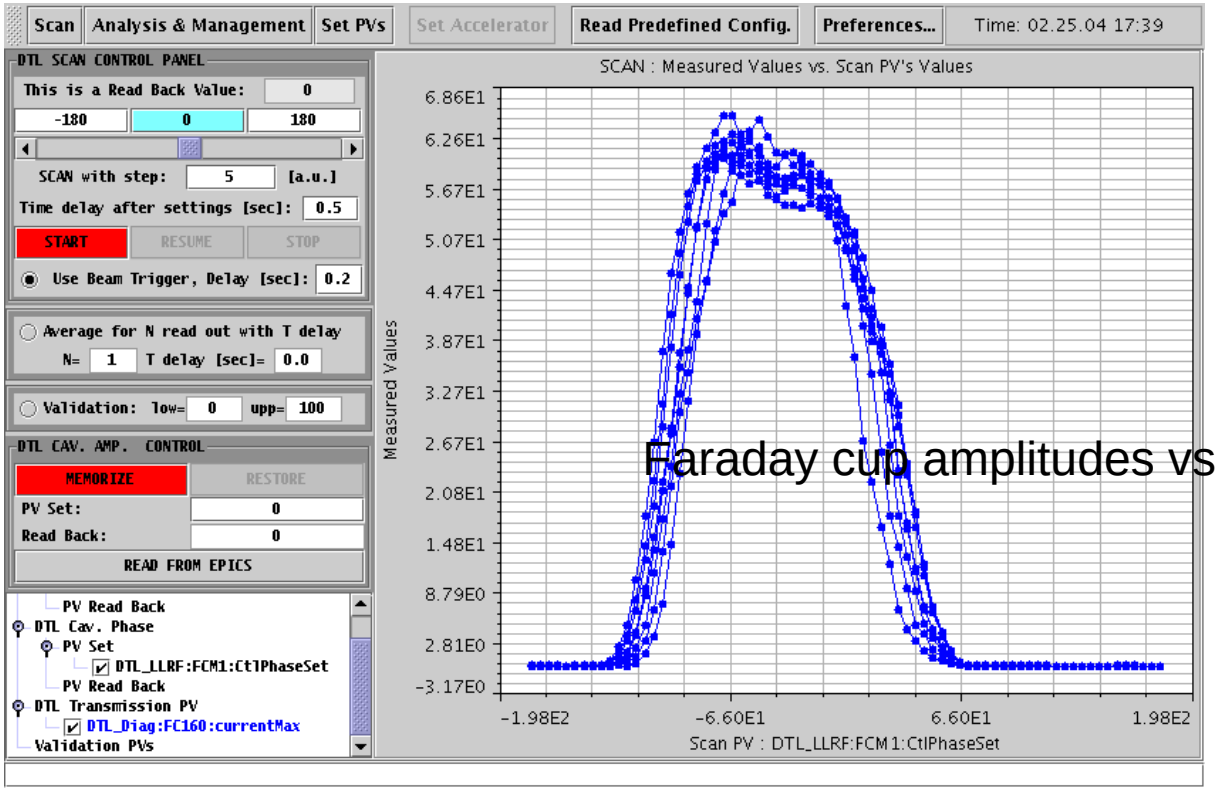
Orbit Display (*Cosylab*)



- Uses the XAL application framework
- Provides statistics
- Can save the setup

1-D Scan Application *(A. Shishlo)*

- Provides an easy way to scan one quantity and monitor others
- Can average over pulses, scan multiple times, pause
- Analysis includes fitting, intersection finding, min/max, etc.
- Easy way to do a quick unanticipated experiment
- Predefined scans with specialized analysis are possible
  - DTL and MEBT phase + amplitude setting applications

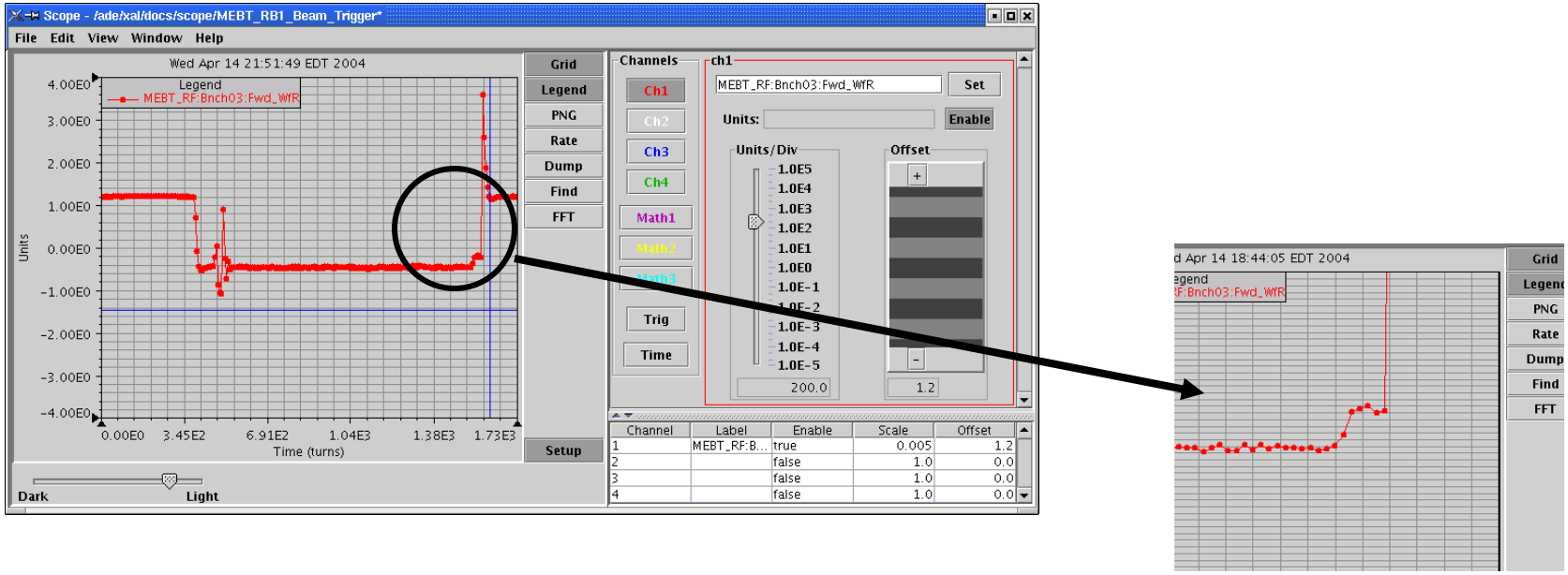


Faraday cup amplitudes vs. DTL RF settings

Scope Application, Triggered Acquisition

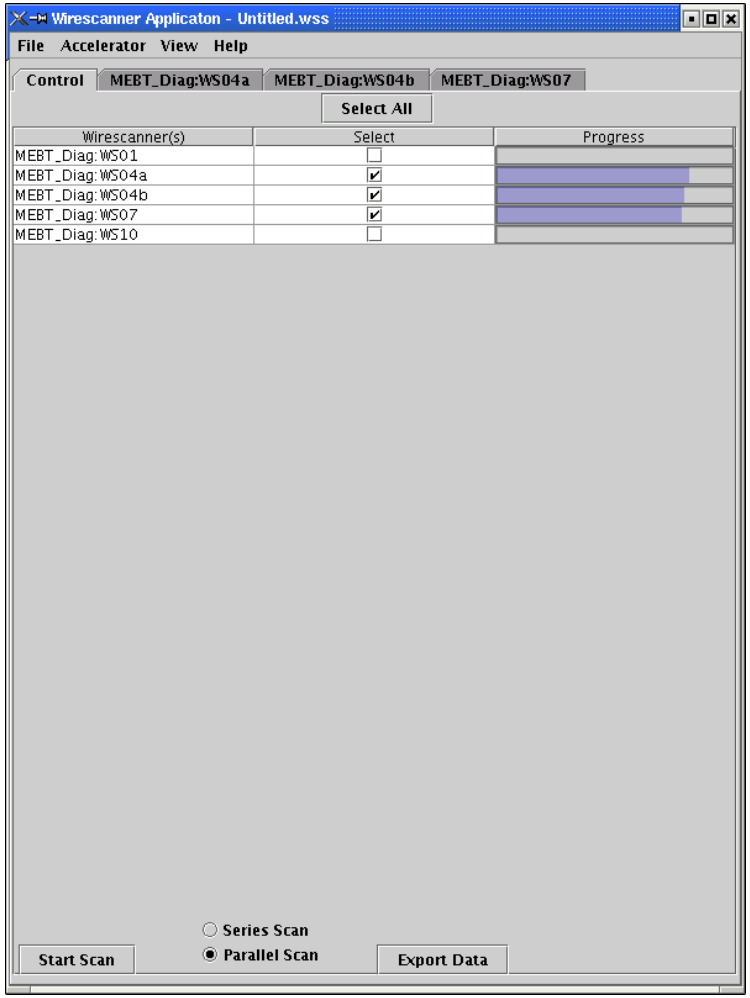
(T. Pelaia)

- The Digital Oscilloscope – with a similar user interface as analog scopes
- MEBT rebuncher (RF) forward power trace with beam loading:
  - RF = 1 msec @ 20 Hz, beam = 50 μsec @ 1 Hz
  - Use the correlator to filter only RF signals with beam pulses
- Potential for future applications
- Requires vigilance on good signal time stamps and proper time waveform packaging



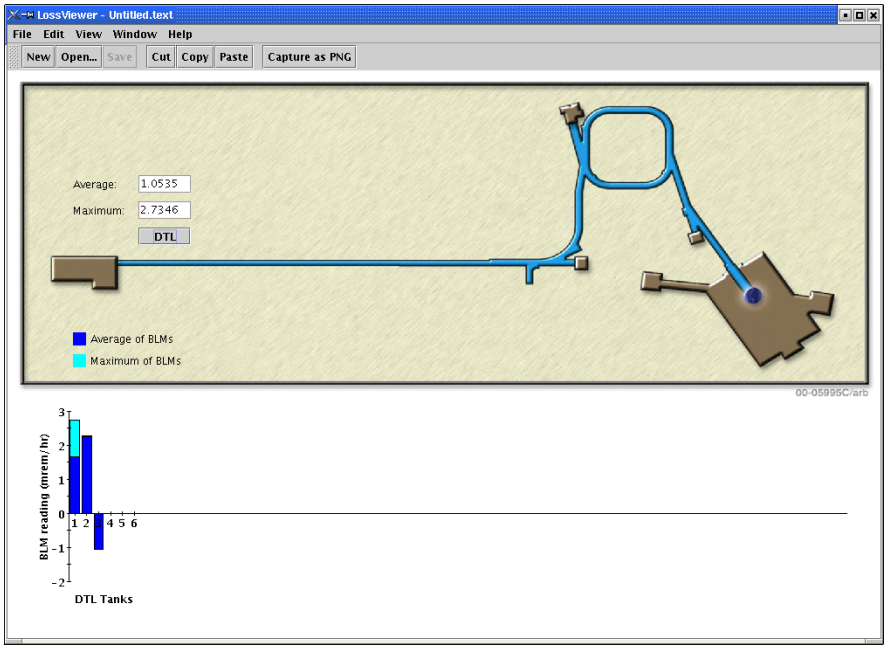
Wirescanner Application (*S. Bunch*)

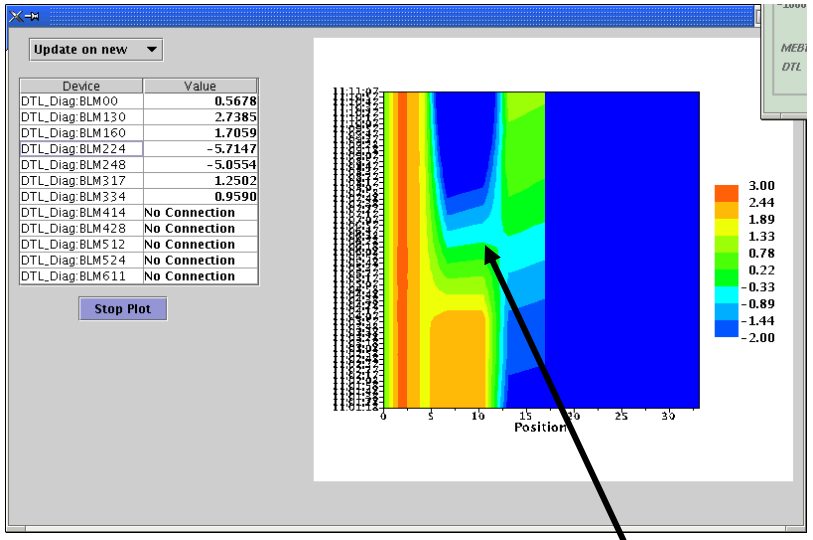
- Provides an easy way to quickly run many wire scans at once
  - Standard accelerator browser
  - Exports wire data to a file
  - View individual profile results
  - Translate data to Matlab format



- Was suggested in last commissioning "lessons learned" (Nov. '03)
  - Student intern started it in Jan. '04
  - Ready for commissioning (April)

Loss Viewer Application *(S.Cousineau)*

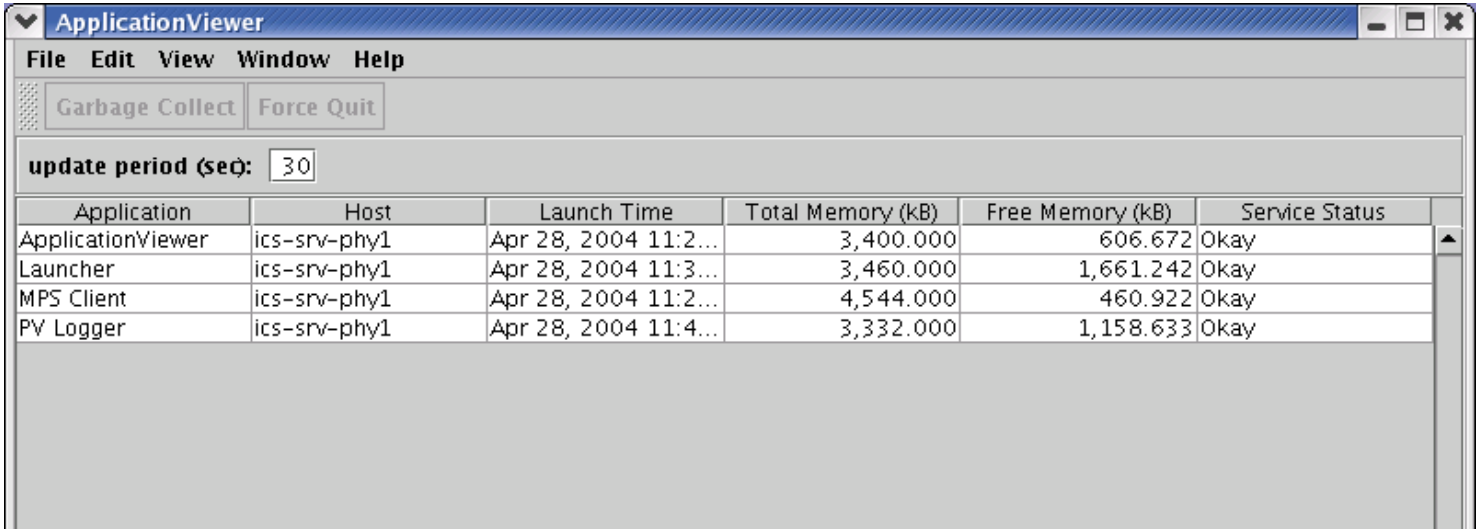




- View a summary of beam loss by machine section
  - "Zoomable" to specific BLMs
  - Viewable as fraction of permissible loss
- Waterfall display of a specific beamline portion
  - Faraday cup inserted here

Service Applications *(T. Pelaia)*

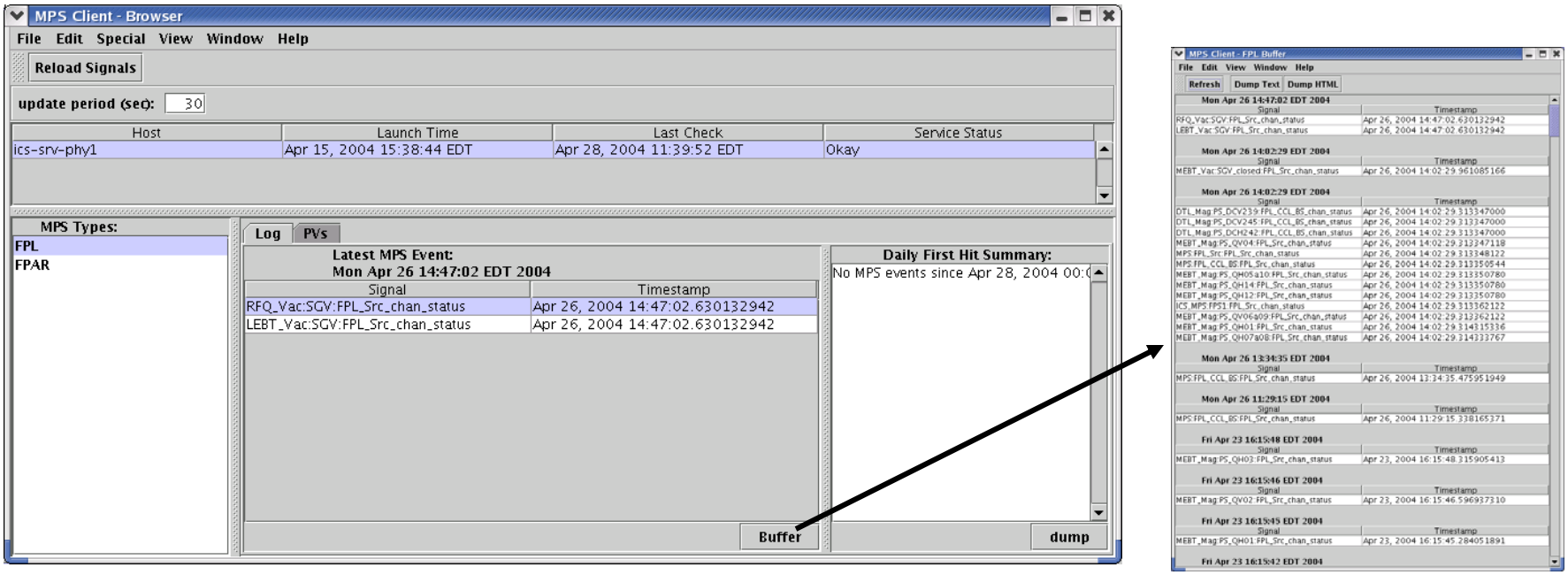
- Started using service based applications
  - Using “off-the-shelf” protocols, services
  - Rendezvous for networking details, Xml-rpc for passing the information – simple interfaces
- Application Viewer uses this to monitor other XAL applications
  - Application framework provides broadcast capability
  - Used to kill “forgotten” applications



Application	Host	Launch Time	Total Memory (kB)	Free Memory (kB)	Service Status
ApplicationViewer	ics-srv-phy1	Apr 28, 2004 11:2...	3,400.000	606.672	Okay
Launcher	ics-srv-phy1	Apr 28, 2004 11:3...	3,460.000	1,661.242	Okay
MPS Client	ics-srv-phy1	Apr 28, 2004 11:2...	4,544.000	460.922	Okay
PV Logger	ics-srv-phy1	Apr 28, 2004 11:4...	3,332.000	1,158.633	Okay

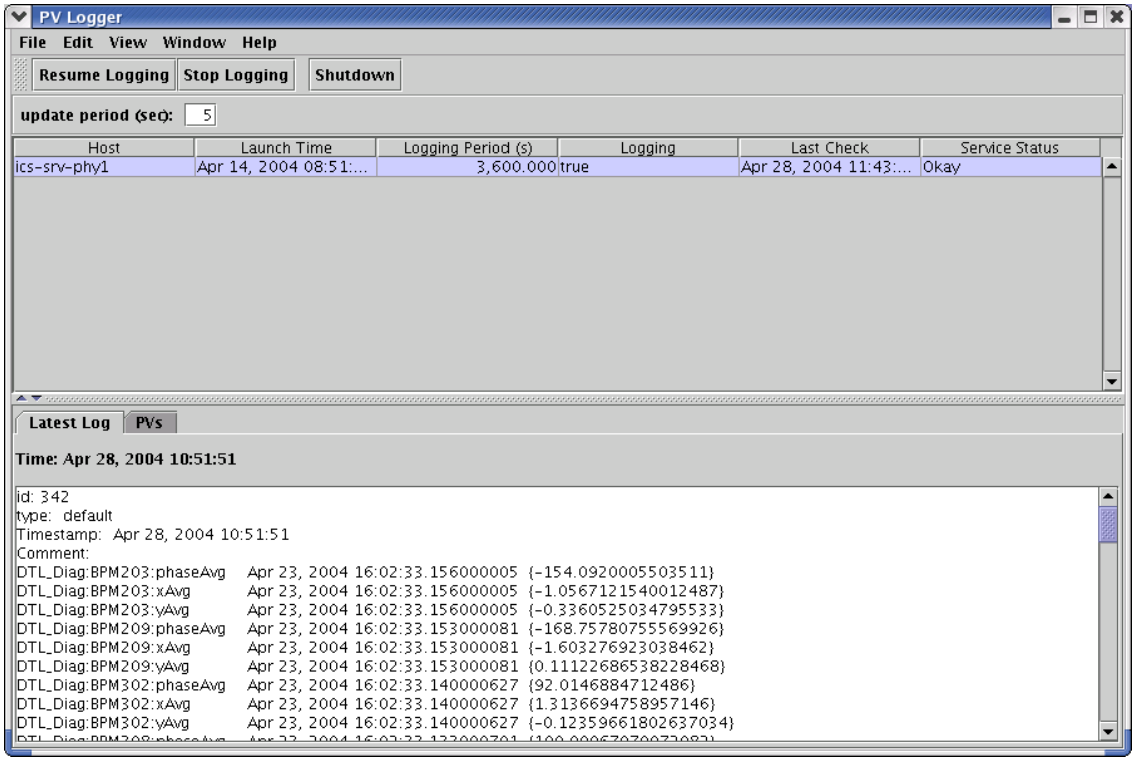
Service Applications, Machine Protection System Post Mortem *(T. Pelaia)*

- Service constantly monitors MPS events, sorts the flood of MPS signals by time per MPS trip
  - Keeps statistics
  - Keeps log of past 1000 events
- Multiple clients can access it to display results
- Replaces the old standalone post mortem



Service Applications, “PV Logger” *(T. Pelaia)*

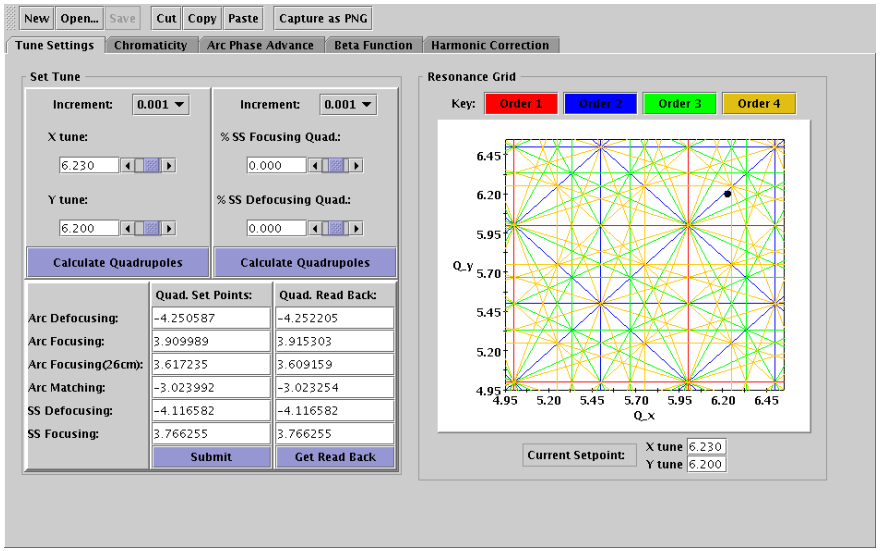
- Server grabs “sets” of data the accelerator physics is interested in
  - Magnet settings, RF settings, BPM readbacks
  - Posts to the database once / hour, or on demand
- Planning to use this as a data source for the online mode



Client application viewing a PV set

Starting on Ring Apps

- Members of the AP group (S. Danilov, S. Cousineau) are preparing Ring applications using XAL tools
- HEBT matching algorithms
- Ring Optics settings
- Injection

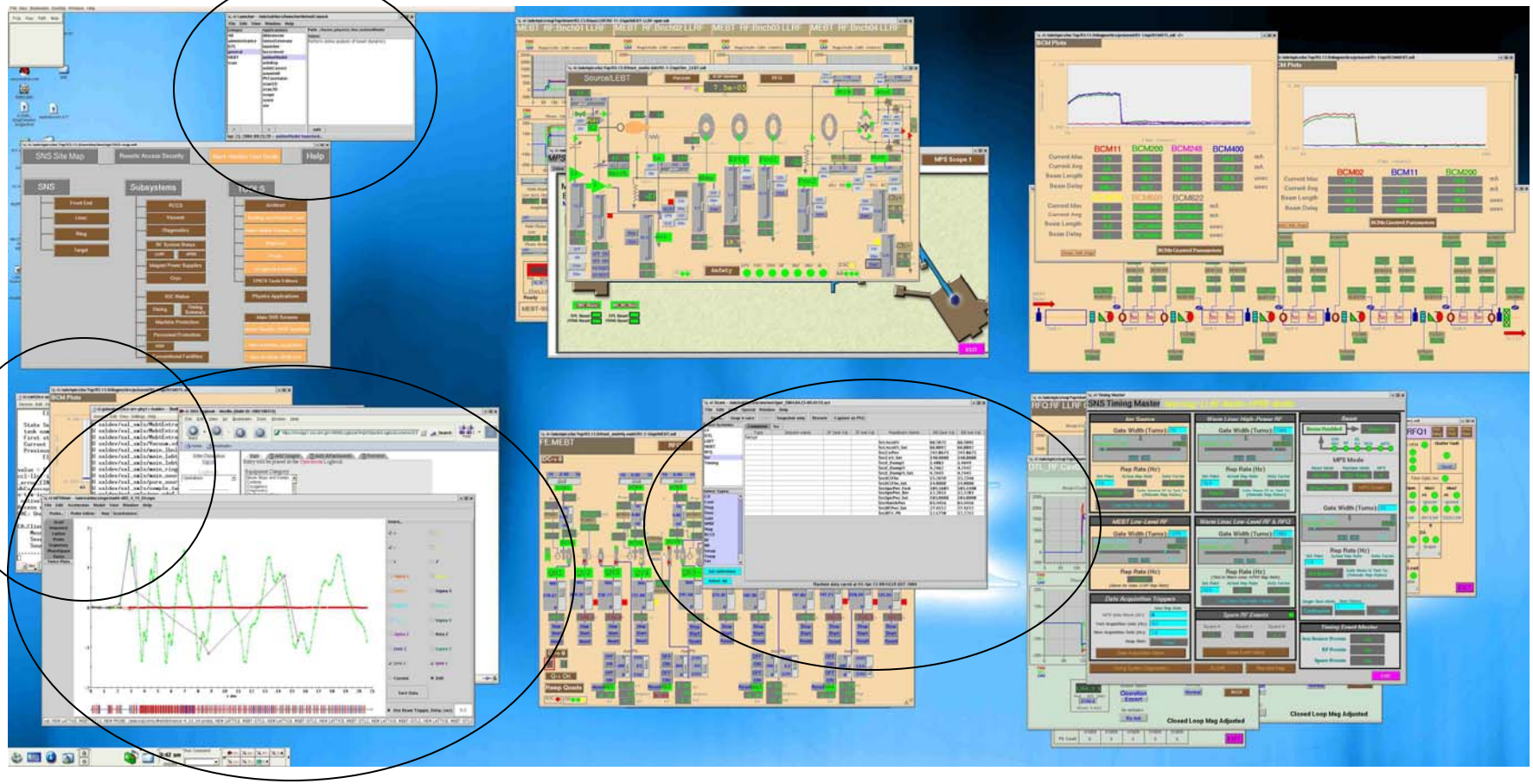


Summary

- The XAL application programming infrastructure is in place and working.
  - ~ 20 applications written
  - Online modeling is available
  - Service applications are started

- Directions
  - More applications
  - Data analysis
  - Database, database, database

XAL is used



- Operator console snapshot, 4/23/04